

December 6, 2021

News and Notes

Before we look some more at the Proterozoic, this time the Neoproterozoic, let's look at some news that I thought were interesting.

Volcanoes

- Mt. Semeru, Java: [Indonesia volcano erupts again as death toll rises to 22](#).
- [La Palma volcano, live updates today: eruption, tsunami warning and latest news | Canary Islands](#); related [Twitter post](#).
- An earth shattering kaboom: [Major explosive event at Sangay volcano, ash to possibly 15.2 km \(50 000 feet\) a.s.l., Ecuador](#), more on the Sangay volcano [here](#).
- [Island turns into open-air lab for tech-savvy volcanologists](#).
- [Worldwide volcano updates](#).

Earthquakes

- [New type of earthquake discovered](#); earthquakes that have been triggered by hydraulic fracturing; original paper [here](#).
- [M 7.5 - 42 km NNW of Barranca, Peru](#).
- [New data will help predict shaking experienced in earthquakes](#).
- Latest earthquake news, [United States Geological Survey](#).

Various Research

- December publications in [Geology](#), journal of the Geological Society of America.
- EurekAlert: [New Geology articles published online](#).
- [Crystal Clues: Earth's Early Magma Oceans Detected in 3.7 Billion Year-Old Greenland Rocks](#).
- [When variations in Earth's orbit drive biological evolution](#).
- [Exploring carbon storage deep beneath the seabed](#).
- Minecraft™ and AI research: [SEIHAI: The hierarchical AI that won the NeurIPS-2020 MineRL competition](#).

Out of This World

- [China's Mars rover has amassed reams of novel geological data](#).
- [Planetary Scientists Discover That Water Was Once Present in Arabia Terra on Mars](#).
- [Life on Mars – Or False Fossils?](#)
- [Astronomers find a new planet that's mostly made of iron](#).

Energy

- U.S Energy Information Administration (USIA): report on [Saudi Arabia](#).
- Also from the USIA: [In 2020, the value of energy trade between the United States and Canada declined](#).
- Podcast: [Why the world needs fossil fuels](#).

Mining

- [Chinchillas throw wrench in Gold Fields' Chile mine expansion plan](#); turn them into fur coats?
- Visit to a rare earth mine, [YouTube](#).
- [EV industry must work closer with lithium suppliers, executives say](#).

Helium

- Press release: [Government of Saskatchewan Launches Helium Action Plan](#).

Paleontology

- [Fossil Hotbed Uncovered in Missouri Confirms New Species of Duck-Billed Dinosaur](#).

December 6, 2021

Neoproterozoic Era

Eon	Era	Period	Ages (mya)
Proterozoic	Neoproterozoic	Ediacaran	630-542
		Cryogenian	850-630
		Tonian	1000-850
	Mesoproterozoic	Stenian	1200-1000
		Ecstasian	1400-1200
		Calymnian	1600-1400
	Paleoproterozoic	Statherian	1800-1400
		Orosirian	2050-1800
		Rhyacian	2300-2050
		Siderian	2500-2300

Figure 1 – Proterozoic Timeline

Credit: Modified from original by Julisa Cummins,
[Creative Commons CC0 1.0 Universal Public Domain Dedication](#)

Continuing on with our examination of the Proterozoic Eon, we'll continue onto [Neoproterozoic Eon](#), the last Era of that Eon. The Neoproterozoic Eon is divided into three Periods: the [Tonian](#), [Cryogenian](#), and [Ediacaran](#) Periods. Let's look at them.

Tonian Period

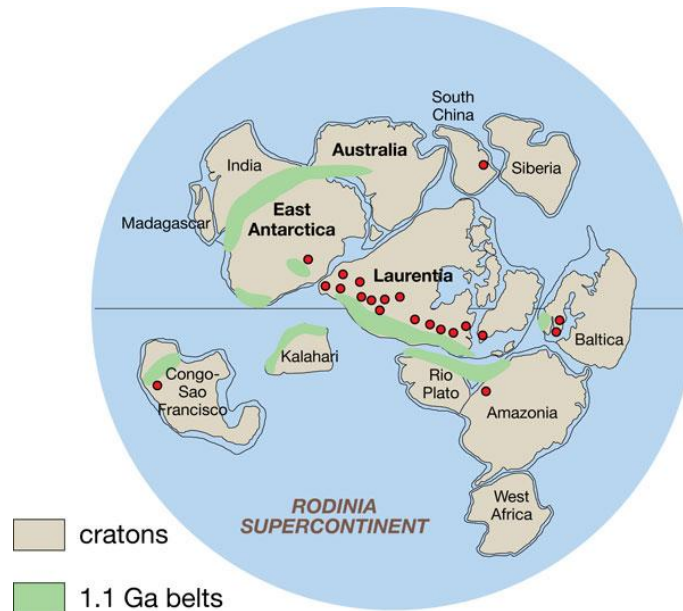


Figure 2 - Supercontinent Rodinia
Credit: John Goodge, public domain

The Tonian Period, 1000 million years ago (Mya) to around 720 Mya is marked by the creation of tectonic rifts that eventually lead to the breakup of the Supercontinent [Rodinia](#). The Period also saw the end of the [Boring Billion](#).

In the fossil record, the beginning of the Tonian is marked by a sharp drop in the occurrence of [Stromatolite](#) fossils and the radiation of [acritarchs](#) fossils. Also, the first sponge like fossils, [Otavia antiqua](#), date from the Tonian Period.

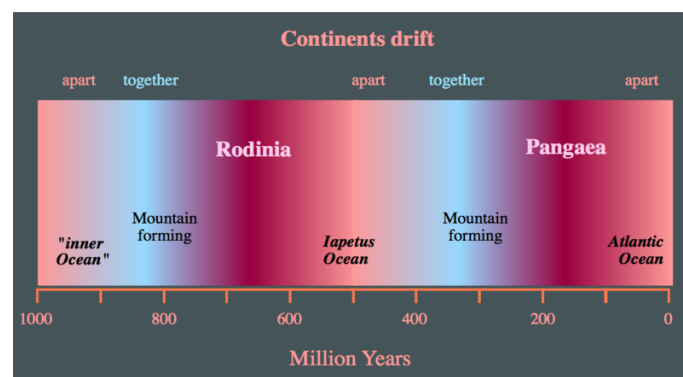


Figure 3 - Wilson Cycle

Credit: Hannes Grobe, Creative Commons Attribution-Share Alike 2.5 Generic license

The accretion of Rodinia during the [Grenville Orogeny](#) and the almost immediate creation of [tectonic rifts](#) that eventually broke up the supercontinent are an example of the [Wilson Cycle](#) in plate tectonics. Proposed by the late [J. Tuzo Wilson](#), sometimes called the founder of plate tectonics, the Wilson Cycle refers to the accretion of supercontinents followed by their inevitable breakup. It's an interesting observation on the action of plate tectonics over time. The YouTube channel, The History of the Earth, has a good discussion on supercontinents in [A Tour of Earth's Ancient Supercontinents](#)

Cryogenian Period



Figure 4 - Snowball Earth

Credit: [たけまる](#), [Creative Commons Attribution-Share Alike 3.0 Unported license](#)

Also called "[Snowball Earth](#)", the Cryogenian Period lasted from 720 Mya to 635 Mya and was marked by two planetary wide glaciations: the [Sturtian](#) and [Marinoan](#). Also, the tectonic rifts that formed previously during the Tonian Period continued to widen, furthering the breakup of Rodinia.

The severe cold climate of the two glaciations during the Cryogenian Period forced evolution of organisms. The fossil record suggest that the following new kinds of organisms appeared during the Cryogenic:

- Fossils of [testate](#) amoeba (or [Arcellinida](#));
- The oldest fossils of definitive [sponges](#) (and therefore [animals](#));
- [Red algae](#), [green algae](#), [stramenopiles](#), [ciliates](#), [dinoflagellates](#); and
- [Heterotrophic plankton](#), which feed on unicellular algae and prokaryotes.

There is a good video discussing the Snowball Earth hypothesis on Naked Science YouTube channel at [Catastrophe - Episode 2 - Snowball Earth](#).

Ediacaran Period

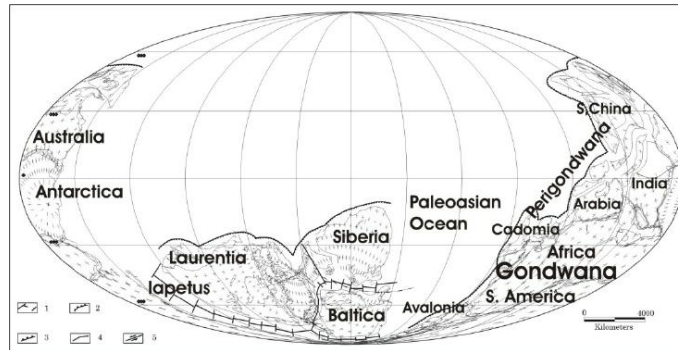


Figure 5 - The World at the Ediacaran-Cambrian Boundary

Credit: Jan Palonka, [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

Lasting from 635 Mya to 542 Mya, the Ediacaran Period marks the beginning of widespread complex life, i.e. [multicellular organisms](#) with tissues. While the fossil record from this period is sparse, among the fossils in the Ediacaran biota are creatures that resemble segmented worms, fronds, disks, or immobile bags such as [Arkarua](#), [Charnia](#), [Dickinsonia](#), [Ediacaria](#), [Marywadea](#), [Onega](#), [Pteridium](#), and [Yorgia](#). The fossils from the Ediacaran Period do not seem to have a direct connection to those that are found in the following Cambrian Period, but further research may uncover the ancestors of the creatures of the Cambrian in the Ediacaran.

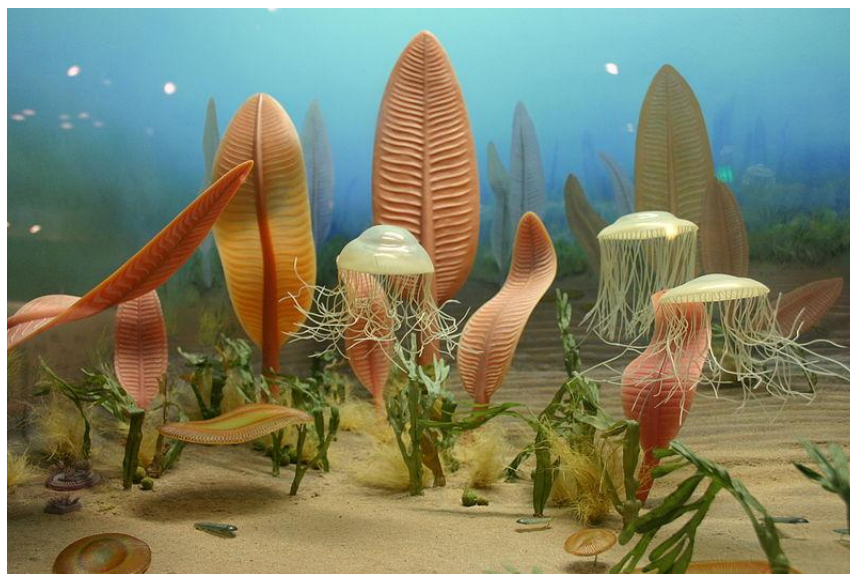


Figure 6 - Artist's Impression of Ediacaran Biota

Credit: Ryan Somma, [Creative Commons Attribution-Share Alike 2.0 Generic](#) license

Other events during the Ediacaran Period include the [Baykonur](#) and [Gaskiers](#) glaciations as well as the continued division of Rodinia along the tectonic rifts.

There is a good lecture on the Ediacaran Period on the Royal Tyrell Museum YouTube channel at [The Ediacaran Period: Glimpses of the Earth's Earliest Animals](#).

Winding Up the Proterozoic

Lasting almost 2 billion years (2,500 Mya- 542 Mya), the Proterozoic was a long time, almost half (4/9ths) of the total age of the Earth. So, three short weblog postings can hardly do it justice and I may return to aspects of it in the future. For now, here are a few short thoughts on the Proterozoic as a whole:

The Proterozoic Eon is incredibly important. It was during this time that the Precambrian continental cores were put together by tectonic forces. More importantly, it was during this long stretch of time that life evolved from single celled creatures to multicellular organisms. Who we are today is the result of what happened then.

Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.